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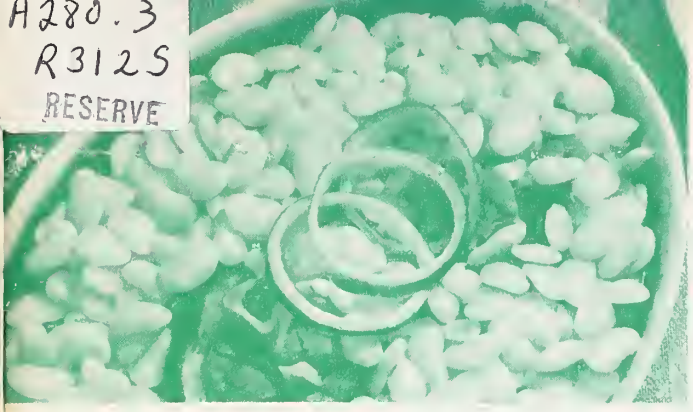
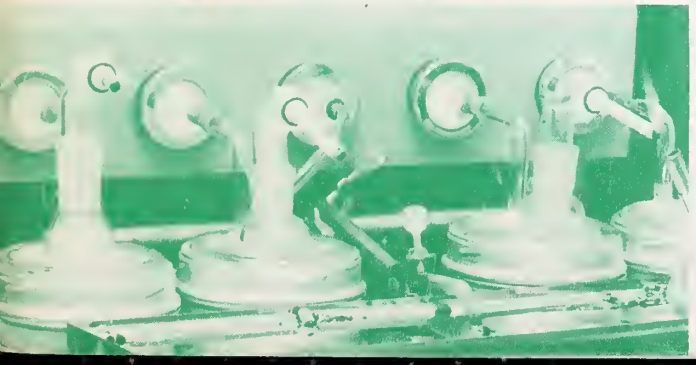


F-Y-1968

SUMMARY REPORT OF

Utilization Research and Development



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U.S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Washington, D.C. April 1969

SUMMARY REPORT OF

Utilization Research and Development

FOREWORD

This report is prepared in response to a request by the Committee on Appropriations in its report to the Senate on the Agricultural and Farm Credit Administration Appropriation Bill, 1960 (Report No. 330), for an annual summary statement on utilization research and development activities conducted by the Agricultural Research Service. Previous reports have been submitted for fiscal years 1959 through 1967.

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

SUMMARY REPORT OF UTILIZATION RESEARCH AND DEVELOPMENT

Fiscal Year 1968

I AIM AND OPERATION OF UTILIZATION RESEARCH

Utilization research, aimed at expansion of agricultural markets and reduction of processing and distribution costs, can increase farm income, benefit domestic consumers, and contribute to U. S. programs of assistance to developing countries. Such research can help to bring into balance the supply of, and demand for, farm commodities. In pursuing its objectives, USDA's utilization research and development effort is directed to: (a) devising new food products that are attractive and economical, and fit the distribution requirements in worldwide market channels; (b) improving functional properties of the natural fibers, cotton, wool, and mohair, to better meet consumer needs; (c) developing more economic and more suitable processed feed products needed in the expansion of the poultry, dairy, and livestock industries; and (d) seeking broadened and profitable industrial uses for agricultural materials.

The Department's utilization research investigations in fiscal year 1968 were conducted primarily in Federal facilities in the United States, consisting of four divisions, or regional laboratories (located in New Orleans, La.; Albany, Calif.; Wyndmoor, Pa.; and Peoria, Ill.) and twelve field laboratories (in Beltsville, Md.; Washington, D. C.; Waltham, Mass.; Lexington, Ky.; East Grand Forks, Minn.; Olustee and Winter Haven, Fla.; Raleigh, N.C.; Weslaco, Tex.; Pasadena, Calif.; Honolulu, Hawaii; and Puyallup, Wash.). During the year, progress was made in the construction of a fifth regional laboratory, at Athens, Ga. Additional research outside of these laboratories and field stations is conducted through contracts, grants, and memoranda of understanding with State Experiment Stations, universities, private research institutions, and industry. Other supporting research is conducted in foreign research institutions through funds generated by the P.L. 480 program (Agricultural Trade Development and Assistance Act of 1954, 83rd Congress, 2nd Session, as amended).

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE

Continuing, positive emphasis is placed on disseminating the results of utilization research to interested segments of the agricultural industry. The following summary illustrates the uses made of various information media in F.Y. 1968:

88 patents granted
1,073 technical papers published
747 speeches, press releases, and appearances on radio and television
38 formal conferences with industrial and other organizations
22 exhibits for the public and technical groups
6,006 technical visitors to UR&D installations

(A) Exhibit Materials

Numerous special exhibits were prepared and shown during F.Y. 1968 to inform the public and technical groups of USDA developments in food fiber, and industrial products made from agricultural sources. Examples of the exhibits are:

Nature of Exhibit	Group Concerned
WURLANized wool (nonportable display)	Oregon Museum of Science and Industry, Portland, Ore. (permanent loan)
Dehydrated foods (nonportable display)	Oregon Museum of Science and Industry, Portland, Ore. (permanent loan)
WURLANized wool (portable display)	California State Fair, Sacramento, Calif. Texas State Fair, Houston, Tex. Montana State Winter Fair, Missoula Mont. Cornell University, Ithaca, N. Y. (for high school science program) Douglas County Livestock Assn. Show, Roseburg, Ore.
Research on new agricultural products (motorized revolving exhibit)	Glenn County Fair, Orland, Calif. California State Fair, Sacramento, Calif. Federal Career Occupational Guidance Week program, San Mateo, Calif.
Rice products (3-panel display)	University of California Picnic Day, Davis, Calif.

(A) Exhibit Materials (contd.)

Nature of Exhibit	Group Concerned
New food products (12 exhibit containers)	University of California Agricultural Extension Service, Modesto, Calif.
Rapid freezing of vegetables (7-panel display)	Northwest Canners and Freezers Convention, Puyallup, Wash.
Uses of crambe oil (panel)	Purdue University Annual Farmers' Field Day, Lafayette, Ind. American Chemical Society, Chemical Trailblazers Exhibit, Chicago, Ill. Joint meeting, American Oil Chemists' Society and American Assn. of Cereal Chemists, Washington, D. C.
Foods by fermentation (panel)	American Chemical Society, Chemical Trailblazers Exhibit, Chicago, Ill.
Starch in rubber--zinc starch xanthate reinforcing agent and accelerator (panel)	Joint meeting, American Oil Chemists' Society and American Assn. of Cereal Chemists, Washington, D. C.
Cotton batting (3-panel display)	Southern Farm Forum, Shreveport, La.
Durable press cotton fabrics (reprint display)	Natl. Technical Conference of Amer. Assn. of Textile Chemists & Colorists, New Orleans, La.
Dried fruit processing and research (16-mm motion picture)	Shown to 46 technical research, sales, and marketing groups
Dry caustic potato peeling (16-mm motion picture)	Shown at Institute of Food Technologists Meeting and 18th Potato Conference, as well as to numerous other groups and individuals

(B) Formal Conferences with Industrial and Other Organizations

During F.Y. 1968, about 40 formal conferences were sponsored by the regional laboratories, often in collaboration with industrial and other outside groups. The following examples are illustrative:

Conference	Sponsors	Attendance	Location
1967 Conference on Citrus Chemistry and Utilization (10/13/67)	USDA	97	Winter Haven, Fla.
Southern Division Oilseed Program Planning Committee meeting (10/30-31/67)	USDA	16	New Orleans, La.
Southern Division Cotton Program Planning Committee meeting (11/1-3/67)	USDA	21	New Orleans, La.
Cotton Blend Conference (11/3/67)	USDA	30	New Orleans, La.
Cottonseed Processing Clinic (2/12-13/68)	USDA, Mississippi Valley Oilseed Processors Assn.	93	New Orleans, La.
14th Annual Joint Conference of Coop. Soybean & Cottonseed Oil Mills (3/4-6/68)	USDA (ARS & Farmer Coop. Service), cooperative soybean and cottonseed oil mills	184	New Orleans, La.
Spring Cotton Advisers Conference (3/11-13/68)	USDA	18	New Orleans, La.
8th Cotton Utilization Research Conference (5/1-3/68)	USDA	212	New Orleans, La.

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attend-ance	Location
Conference on Protein-Rich Food Products from Oilseeds (5/15-16/68	USDA, State Expt. Sta. directors, Natl. Cottonseed Processors Assn., Natl. Peanut Council, SW Peanut Shellers Assn.	191	New Orleans, La.
Citrus Research Conference (12/6/67)	USDA, citrus industry	70	Pasadena, Calif.
Wine Institute Vinicultural Research Committee (1/31/68)	USDA, Wine Institute	38	Albany, Calif.
Western Experiment Station Collaborators' Conference (3/13-15/68)	USDA, University of California	134	Albany, Calif.
Amer. Bakers Assn. Technical Liaison Committee with USDA (11/15-17/67)	USDA, Amer. Bakers Assn.	45	Albany, Calif.
Lemon Products Technical Comm. (four times during year)	USDA, lemon industry	60	Pasadena, Calif.
Northwest Canners & Freezers Association (1/8-9/68)	USDA, NW Canners & Freezers Assn., State Expt. Stations	2000	Portland, Ore.
Dried Fruit Industry Research Advisory Committee (6/7/68)	USDA, dried fruit industry	67	Fresno, Calif.
Dried Fruit Association Scientific Advisory Committee (four times during year)	USDA, dried fruit industry	80	San Francisco, Fresno, and Santa Clara, Calif.
U. S. Brewers Assn., Hops Research Committee (1/25/68)	USDA, U.S. Brewers Assn.	23	Albany, Calif.

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attend-ance	Location
17th Natl. Potato Utilization Conference (7/24-26/67)	USDA, United Fresh Fruit & Veg. Assn., Maine potato industry, U. of Maine Agr. Expt. Sta. & Ext. Service, Aroostook State College, Maine Dept. Agric.	301	Presque Isle, Me.
Tobacco Research Review (10/4/67)	USDA	8	Wyndmoor, Pa.
Eastern Agric. Expt. Sta. Collaborators' Conference on Food Flavor (10/24-25/67)	USDA	91	Wyndmoor, Pa.
Northeast Dairy Coop. Regional Study Committee (4/9/68)	USDA	41	Washington, D.C.
Meat Packers & Processors Conference (4/16-17/68)	USDA, Penna. State U., Montgomery Co. Agr. Ext. Service	69	Ft. Washington, Pa.
Cigar Mfrs. Assn. of America, Research Subcom. Meeting (4/30/68)	USDA, Cigar Mfrs. Assn. of America	7	Wyndmoor, Pa.
Fatty Acid Producers Council Research & Technical Committee Meeting (5/23/68)	USDA	19	Wyndmoor, Pa.
Technical Committee S-9 on New Plants (7/18-19/67)	USDA	20	College Sta., Tex.

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attend-ance	Location
Natl. Coordinating Committee on New Crops (8/22-23/67)	USDA (ARS & CSRS), State Agr. Expt. Stas.	29	Ft. Collins, Colo.
Annual Corn & Wheat Utilization Conference (10/26-27/67)	USDA, Corn Industries Research Foundation	64	Peoria, Ill.
5th Natl. Conference on Wheat Utilization Research (11/1-3/67)	USDA, Great Plains Wheat, Inc., Millers Natl. Federation, Natl. Assn. of Wheat Growers, N. Dak. State Wheat Commission, Western Wheat Associates, etc.	145	Fargo, N.D.
North Central Agr. Expt. Sta. Collaborators' Symposium on Chemical Activities of Micro-organisms (3/25-26/68)	USDA, North Central Agr. Expt. Sta. collaborators	64	Peoria, Ill.
Soybean Utilization Research Conference (4/19/68)	USDA, Natl. Soybean Processors Assn.	42	Peoria, Ill.
Annual Corn Dry Milling Conference (6/24-25/68)	USDA, Amer. Corn Millers Federation	52	Peoria, Ill.

(C) Rural Area Development Activities

During F.Y. 1968, much attention was given to fostering the establishment of agricultural processing enterprises in rural areas. Technical and economic advice was provided on many subjects, particularly to existing or projected small business enterprises and to state or regional planning groups. Examples of the subjects covered are given below.

Basic requirements of vegetable and fruit processing in the Rio Grande Valley (Texas)

Establishment of peanut processing facilities (Northampton County, N.C.)

Processing of discount cottons (Texas)

Establishment of sweetpotato flake processing plants (St. Francisville, La., and Eastville, Va.)

Establishment of peanut flour processing facilities (Graceville, Fla.)

Improved procedures for preparing vegetables for shipping (Lamesa, Tex.)

Extraction of oil from cottonseed with aqueous acetone solvent (Dothan, Ala.)

Durable-press finishing of cotton (several states)

Establishment of plants for cotton finishing, mechanical processing of cotton, and fruit and vegetable processing (Columbia, S. C.)

New technique for lye peeling of potatoes that reduces stream pollution problems (Twin Falls, Caldwell, and Burley, Idaho, and Ontario, Ore.)

Adaptation of the USDA "foam-mat" process to the drying of berry juices and tomato pulp (Corvallis, Ore.)

Production of raisin paste (Fresno, Kingsburg, Delano, and Sanger, Calif.)

Production of "instant" drum-dried apple flakes for military rations (Cowichee, Wash.)

Tanning of woolskins by glutaraldehyde process to produce such items as pads, chair seats, and throw rugs (sheep-raising states)

Improvements in handling maple sap and its conversion to sirup and confections (Maine, Pennsylvania, Ohio, Michigan, Indiana, New York, and Minnesota)

(C) Rural Area Development Activities (contd.)

Ultraviolet irradiation to preserve unpasteurized cider for sale at roadside stands and in food markets (cider producers and equipment manufacturers in 28 states)

Improved methods of handling and processing mechanically-harvested red tart cherries (Michigan, Pennsylvania, New York)

Extension of meat packing in small rural plants through development of new methods for processing cured and smoked meats, new types of prepared items, and new fabricated products from lamb and mutton (various states)

Foam-spray drying of milk, whey, and other dairy products (California, Pennsylvania, Maryland, and other dairy states)

Production of low-fat cheese (leading cheesemaking states)

Production of waxy and high-amylose corn and starch, particularly for cash export markets (Farmer City, Ill.)

Industrial uses and markets for corn and soybeans (Danville, Ill.)

Production of acid-modified flour, a USDA development (Lowell, Mich.)

Fiber crops and agricultural residues as papermaking raw materials (Cambridge, Ind.)

Handling and processing of kenaf and other nonwood fiber raw materials (Palatka, Fla.)

Protein glue for southern pine plywood (Stuttgart, Ark.)

Production of full-fat soy flour (Ephrata, Wash.)

Soybean processing (Uniontown, Ala.)

Reducing the microbial count in flour (Greenville, Ill.)

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS

Cooperative work with other groups is undertaken to develop new products, to improve existing products and processes, to devise economic processes for product manufacture, to evaluate products and processes, and to explore new outlets for agricultural products. These cooperative efforts contribute to early commercialization and broadened usage. Examples of cooperative research and development are as follows:

Activity	Cooperators with USDA
Development of efficient, low-cost, flame retardant treatments for cotton batting	Natl. Cotton Batting Inst., Textile Fibers & By-products Assn., Foundation for Cotton Research & Education, Natl. Cotton Products Assn.
Improved outdoor cotton fabrics	Canvas Products Assn. Internatl., Foundation for Cotton Research & Education, Cotton Producers Inst.
Improved cotton fabric structures for men's garments developed and reversible crosslinking processes studied	Cotton Producers Inst.
Cotton fabrics treated by new chemical process for use in sandbags	Army Mobility Equipment R&D Center, Ft. Belvoir, Va.
Better insect-resistant cotton bags for storage and shipment of cereal foods	Textile Bag Mfrs. Assn.
Evaluation of high-quality cottonseed and peanut flours for human consumption in developing countries	Agency for International Development
Investigation of cottonseed protein systems as basis for developing high-protein food products	Foundation for Cotton Research & Education, Natl. Cottonseed Products Assn., Cotton Producers Inst.

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Orange and grapefruit crystals for instant juice with consumer appeal	Florida Citrus Commission
Fermentative processing of cucumbers and other vegetables	Pickle Packers Internatl., North Carolina and Michigan Agric. Expt. Stas.
Development of an economically-produced botrytized wine to compete with expensive imported wines of this type	Paul Masson Winery
Development of commercial processing lines for making raisin paste	SunMaid Raisin Company
Evaluation of puffed, rolled cereal grains for feeding cattle	University of California School of Agriculture, Davis
Development of pilot plant to examine the potential of brine reclamation from olive processing operations	Lindsay Olive Processors, Fedl. Water Pollution Control Admin.
Development of inexpensive technique for maturation of immature dates, and of an antimycotic treatment to protect dates from spoilage during storage	California Date Growers Assn.
Commercial development of techniques for separating leaf and stem fractions of dehydrated alfalfa to produce two alfalfa products of increased value	Nebraska State Department of Economic Development
Development of a manual to help egg products industry supply Salmonella-free products to users	Inst. of American Poultry Industries
Improved cider and cider products	Steroline Systems Corp.
Dehydrating fruits for rapid rehydration	Musselman Division of Pet, Inc.

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Storage stability of fluid milk during iodine-131 decay	Pet, Inc.
Development of new foods containing cheese whey	UNICEF
Additive chlorination and hydrogenation of animal fats	Ashland Chemical Co.
High-pressure hydrogenolysis of animal fats	Swift and Company
Neutral constituents in cigar smoke from different cigar types	Cigar Mfrs. Assn. of America
Influence of combustion modifiers on the vapor phase constituents of cigarette smoke	Houdry Laboratories, Air Products & Chemicals, Inc.
Development and evaluation of cigarette modifiers which alter smoke composition	University of Kentucky, American Tobacco Co.
Development of high-amylose corn for industrial use	Bear Hybrid Corn Co.
Full-fat soy flour for developing countries	Agency for International Development
Commercial processing of crambe seed as a new industrial crop	Southern Indiana Agricultural Improvement Assn.
Use of linseed oil in coating compositions	North Dakota State Univ., Natl. Flaxseed Processors Assn.
Use of solvent-extracted crambe meal to supplement ruminant feeds	University of Nebraska
Use of wheat products in pulp and paper industries	Washington State University

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS

(A) Planning and Advisory Activities

The USDA program of utilization research on farm commodities is the product of extensive planning that is continually updated. Its administration is the direct responsibility of a deputy administrator of the Agricultural Research Service, his supporting staff, and the directors of the four regional research laboratories. A Program Planning and Evaluation Staff of ARS, composed of economic specialists, assists this administrative group in evaluating the appropriateness and commercial feasibility of proposed and existing utilization research projects. Information and guidance is sought from various other sources both within and without the Department. Among the advisory groups that oversee the program, the following may be mentioned:

National Program of Research for Agriculture. Pursuant to a directive from the Senate Committee on Appropriations (Senate Report No. 156), in 1965-1966 a joint study was made by representatives of USDA, State Agricultural Experiment Stations, and the land-grant colleges, to look into all areas of agricultural research conducted by the Department and the State Experiment Stations. A report of the study, entitled "A National Program of Research for Agriculture" and essentially completed in F.Y. 1966, includes an appraisal of the current status of agricultural research and definition of future agricultural needs.

To implement the recommendations of the National Program, the establishment of 32 task forces was recommended. The following are concerned with utilization research: Cotton; soybeans; peanuts; corn and grain sorghum; wheat and other small grains; rice; fruits; vegetables; sugar crops; tobacco; minor oilseeds as well as miscellaneous and new crops; forestry; forage, range, and pasture; beef; dairy; swine; poultry; sheep and other animals; food and nutrition; food safety; pollution in relation to agriculture; and foreign aid and market development.

Committee on Agricultural Science. An advisory group was established in 1962 of 16 eminent scientists representing such disciplines as biochemistry, physiology, rural sociology, marketing, and economics. This group, which includes representatives of state universities and agricultural experiment stations, evaluates the quality of research and the factors essential to a favorable scientific environment, and makes recommendations concerning USDA research in basic sciences.

Agricultural Research Planning Committee. A 15-member advisory committee was established in 1964, composed of USDA's Director of Science and Education; six representatives from USDA research agencies; six representatives of, or nominees of, State universities and land-grant colleges; one member nominated by the National Academy of Sciences; and one member nominated by the Office of Science and Technology. This committee primarily assists in planning, evaluating, and coordinating unified long-range agricultural research programs, and in delineating the appropriate areas of responsibility of Federal and State agencies that carry out these programs.

National Agricultural Research Advisory Committee. An 11-member advisory committee, with broad national interests in all phases of agriculture, evaluates the Department's entire research program and offers suggestions, particularly on policy matters, for changes in the program. Six of the committee members are representatives of producers or producer organizations.

National Advisory Committee on Rural Areas Development. An advisory committee representing agricultural industries, farmers, educational institutions, finance groups, and regional representatives, that makes recommendations for the greater development of rural areas.

Commodity and Functional Advisory Committees. There are 14 commodity and functional advisory committees, authorized under the Research and Marketing Act of 1946, that offer suggestions on present work, make recommendations on needed future direction of research, and assure more effective communications with the many organizations interested in agricultural research. Of these committees, the following are concerned with utilization research: Animal and animal products, cotton, forestry, grain and forage crops, horticultural crops, oilseed and peanut crops, sugar crops, tobacco, and utilization research and development.

Agricultural Assocations and Industry Groups. Advice is sought from, and information is exchanged with, all segments of the agricultural industry, including growers, shippers, processors, and distributors, concerning the many problems involved in the profitable development of new or improved uses for agricultural commodities.

Consumer Interests. Information on consumer desires for new or improved products, and on evaluation of such products, is sought through contacts with consumer groups of national and regional scope. Other USDA groups--the Economic Research Service, the Federal Extension Service, and the ARS market and consumer use research groups--provide advice on consumer needs and market trends.

(B) Program Appraisal and Redirection

The utilization research program is continually reviewed to assess its fruitfulness. Investigations that have reached their objectives are discontinued. Investigations that have passed the point of maximum returns, or are otherwise relatively unproductive, also are discontinued so that the resources may be more effectively applied to new programs. More promising investigations are established or intensified, either by reduction of effort on projects of lesser importance or by use of such new resources as may become available. Examples of the redirection of research effort are shown below:

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Cereal and Forage Crops	
Protein-rich food products from feed fractions of wheat	Relation of wheat starch granule properties to baking quality
Basic studies of new crosslinked starch derivatives	Reinforcement of rubber by incorporation of starch products
Development of edible films from amylose starch	Development of biodegradable detergents and surfactants from starch
Development of tempeh-like fermented wheat food for increased export of wheat to the Orient	Development of rennin-like products for cheesemaking by fermenting wheat products
Search for antibiotics to protect plants from disease	Development of ensiling process for eliminating aflatoxin from contaminated grain
Cotton, Wool, and Other Fibers	
Improving the production and performance characteristics of chemically-treated cotton batting	Development of efficient, low-cost, flame-retardant treatments for cotton batting
Stable crosslinking agents suitable for use in delayed-cure processes for cotton	Improvement of durable-press cotton fabrics through the use of a wet-fixation technique

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Cotton, Wool, and Other Fibers (contd)	
Mechanisms involved in producing crease-resistant cotton by esterification with derivatives of monobasic acids	Correlation of changes in properties with changes in fine structure of modified cotton
Improved abrasion resistance in cotton fabrics from crosslinking of partially swollen cotton	Chemical modification of cotton cellulose in addition to crosslinking or other finishing treatments, to improve durable-press products
Separation and identification of the cleavage products of partially etherified cotton	Structural composition of selected chemically modified and crosslinked cotton cellulose
Development and evaluation of a new machine for opening and blending bales of cotton in any desired proportion	Modification of the feed system of the SRRL Cotton Bale Opener-Blender to provide a uniform delivery of blended stock
Treatment of cotton with finishes containing selected lead and other metal compounds to impart specific properties	Treatment of cotton to impart flame and rot resistance
High-energy radiation effects on wool	Blending wool and cotton fibers on the cotton processing system
Fruits and Vegetables	
Improvement of processed grapefruit products by preventing or minimizing the formation of bitter components	Treatment of pigments from orange peel to obtain colored extract suitable for enhancing the color of juice products
Fungal spoilage in grape concentrate	Stabilization of lemon oil and lemon flavors
Composition and quality control of raisins	Changes in pesticide residues during processing of fruits and vegetables

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Fruits and Vegetables (contd)	
Basic research on after-cooking discoloration of potatoes and on the lipid fraction of potatoes	Recovery of proteins and amino acids from potato processing wastes to alleviate pollution
Oilseeds	
Selective hydrogenation of soybean oil to improve flavor stability (decreased effort)	Lower-cost process for refining soybean oil with alleviation of water pollution
Chemical modification of soybean oil to improve flavor stability (decreased effort)	Study of lipid-modifying enzymes of soybeans as a basis for preventing oxidative and rancid flavors in the edible oil and protein products
Isolation of the cyclopropenoid fatty acids in cottonseed oil and investigation of their chemical and physical properties important to the preparation and use of cottonseed products	Reactions of cyclopropene acids and their derivatives in the processing of cottonseed oil for use in food products and development of remedial or control methods
Preparation of cottonseed and peanut flours for human consumption	Development of a continuous liquid classification process for the production of cottonseed flours and concentrates for food
New and Special Plants	
Conversion of rosin, resin acids, and pine gum derivatives into polyols for use in polyurethane applications	Preparation and evaluation of polyurethanes derived from rosin, resin acids, and pine gum
Production of useful chemicals from terpenes and resin acids by free-radical addition of functional groups	Application of photochemical reactions to pine gum, terpenes, resin acids, and their derivatives to produce new compounds of potential utility

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
Poultry, Dairy, and Other Animal Products	
Flavor, tenderness, stability, and rehydration of freeze-dried poultry meat	Physicochemical studies of binding of the egg proteins, lysozyme and ovomucin
Basic research on low-fat cheese	Concentration and fractionation of dairy products, especially cheese whey, by reverse osmosis
Development of foam-spray dried whole milk powder (decreased effort)	Development of new foods containing whey
Development of vacuum-foam dried whole milk powder (decreased effort)	Improved methodology for identification and control of Salmonella in meat and bone meal
Leather tanning with combination tannages containing glutaraldehyde	Chemical modification of hides with reactive dyes to produce leathers with colors fast to washing and dry-cleaning
Characterization of hide lipids and their distribution within hides	Studies on the preservation of hides through pickling

(C) Status of Domestic Research Projects

Summary Statement

	Active at beginning FY 1968	Initiated or revised	Terminated	Active at end FY 1968
Domestic	441	145	135*	451**
Foreign (P.L. 480)	149	13	36	126
Total	590	158	171	577

Commodity Classification of New Domestic Work Undertaken in FY 1968

	Domestic	Foreign	Total
Cereal and forage crops	37	1	38
Cotton, wool, and other fibers	25	3	28
Fruits and vegetables	23	3	26
Oilseeds	22	4	26
New and special plants	17	0	17
Poultry, dairy, and other animal products	21	2	23
Total	145	13	158

* 122 projects were terminated because the objectives had been wholly or substantially achieved; the remaining 13 projects were terminated because the results were unpromising, or because the work was superseded by research of higher priority.

** Includes 166 domestic contract and grant projects, 18 projects wholly or partly supported by industry (fellowships and direct financial support), and 4 projects supported by funds transferred from other Federal agencies.

(D) New or Expanded Research Initiated with New Appropriations in FY 1968

Cereals and Forage Crops

Determination of microorganisms in corn and grain sorghum and their milled products, to provide a basis for reducing the microbial population in food products from these cereal grains (in-house)

Cotton, Wool, and Other Fibers

Development of mechanical processing and blending techniques to increase the utilization of "discount" cottons (contract)

Fruits and Vegetables

Control of bacterial spores in commercially canned vegetables (expansion of existing in-house program)

Prevention of microbiological contamination of dried fruits, fruit concentrates, and fruit juices (expansion of existing in-house program)

Oilseeds

Production of salmonella-free cottonseed meal products (in-house)

Rapid detection of mold and mycotoxin contamination in peanuts during processing (in-house)

New and Special Plants

Development of reverse osmosis techniques for low-cost concentration of maple sap (in-house)

Poultry, Dairy, and Other Animal Products

Elimination of salmonella from poultry meat products (in-house)

Determination of survival of salmonella in milk and cheese (expansion of existing in-house program)

Elimination of salmonella from meat and meat products (in-house)

V CURRENT UTILIZATION RESEARCH PROGRAM

USDA's utilization research program is directed to finding new or improved uses and improved processing methods for agricultural commodities through basic, applied, and development research. As previously indicated, it is subject to continual review and appraisal at all levels, from work units (limited assignments involving up to several man-years of effort for periods of not more than five years) up through broad general areas of activity. As examples of program changes in the latter category, it may be mentioned that increasing attention is being given to food safety, with major emphasis on elimination of salmonella bacteria from foods and feeds, and on control of toxins from fungi in foods and feeds; to development of products specifically suited to cash export markets; and to development of modifications in the processing of agricultural commodities that will minimize air and water pollution problems.

The following listing of subject fields will illustrate the general nature of the current program:

Cereal and Forage Crops

Emphasis on development of new uses for corn and wheat, with concurrent effort on rice, barley, oats, sorghum, and alfalfa and other legume and grass forages:

New and improved food products--Improved continuous-mix processes for bread and rolls; improved quality retention in frozen fermented bread doughs; protein-rich export foods from wheat flours and millfeed fractions and concentrates; fermented wheat foods for use in export markets; determination of blending characteristics of U. S. winter wheats for increased use in European countries; improved milling and fractionation methods for production of wheat fractions of improved yield and quality for foods; improved maturation of bread flours by methods acceptable in European countries; improved milling of artificially dried corn; new low-cost corn foods for institutional markets; lower-cost consumer products from short- and medium-grain rice; grain sorghum endosperm products for use in convenience foods; improved conversion of cereal starch to sugars and sirups; control of fungus toxins in grain; control of microorganisms in cereal flours.

Improved feeds--Improving the nutritive value of alfalfa, wheat, and small grains and mill fractions for ruminant, poultry, and swine feeds; dense, stable, concentrated, low-fiber forage products for export; "off-the-farm" processes to produce improved ruminant feeds from highly lignified agricultural materials.

New industrial uses--Development of starch-derived chemicals for plastics and coatings; development of starch-xanthides as wet-strength agents in paper; acid-modified flour for surface sizing of paper; cationic starches and flours for coating and sizing paper; starch-graft copolymers as flocculating, viscosity-improver, and adhesive agents; dialdehyde starch-protein plywood glue; rubber reinforcing agents from starch; biodegradable detergent builders from starch; colloidal microbial polysaccharides for industrial use; high-amylose corn starch for industrial use; microbial spores for converting cereal grains to industrial products; use of spores in controlling Japanese beetle infestations.

Cotton, Wool, and Other Fibers

New functional properties imparted to cotton, wool, and mohair through chemical, physical, and mechanical processing research and development, supported by comprehensive fundamental studies of fiber properties and modification:

Cotton chemical processing--Improved durable-press cotton fabrics; flame-retardant cotton products with other desirable properties; low-cost, flame-retardant cotton batting; insect-resistant and easily reusable cotton cereal grain bags; improved mildew-, rot-, water-, weather-, and air pollution-resistant cotton products; improved soil resistance, launderability, and drying characteristics in cotton products.

Cotton mechanical processing--Improved cotton prespinning processes; improved cotton spinning efficiency and yarn quality; aerodynamic-electrostatic-ultrasonic spinning system; improved utilization of discount cottons.

Improved wool and mohair products--Improved efficiency in the processing of worsted wool and mohair products; improved wool and mohair products requiring mimimum upkeep; improved fabrics from wool and mohair blends.

Fruits and Vegetables

Development of convenience-in-use fruit and vegetable products, and processing equipment for their economic manufacture, together with fundamental investigations of factors affecting color, texture, and flavor:

Citrus and subtropical fruits--Citrus products with improved flavor, color, and stability; comminuted citrus products; foam-mat-dried orange products; new products from desert grapefruit; improved red grapefruit and other Texas citrus products; freeze-dried and subtropical fruit and citrus products; sweetening agents from citrus flavonoids; improved stability and flavor of non-frozen subtropical fruit juice concentrates and purees.

Deciduous fruits and berries--Evaluation of processing characteristics of Pacific northwest berries and other fruit; improved piece-form and powdered dehydrated fruit products; dried fruit and tree nut products for foreign markets; improved cider and cider processing; reducing processing losses from mechanically harvested apples and sweet cherries; processing mechanically harvested dates; improved processes for wine production; application of "explosion-puffing" techniques to apples, pears, apricots, and prunes; control of pollution and conversion of waste products of fruit processing; reduced microbial contamination in processing of fruits; changes in pesticide residues during processing of fruits.

Vegetables--Frozen vegetables with improved texture; dehydrated vegetables of improved quality and stability for export markets; evaluation of processing characteristics of Pacific northwest vegetables; improving the color, flavor, and stability of processed white potatoes; improved processed products from southern-grown tomatoes; control of consistency of tomato products; convenience foods from dry beans and peas; dehydrated celery products with improved flavor; canned low-acid foods of improved quality and safety; modified and enriched products from sweetpotato puree and flakes; application of "explosion-puff" techniques to potatoes, carrots, celery, green peas, and lima beans; control of pollution and conversion of waste products from the processing of potatoes and other vegetables; reduced microbial contamination in vegetable processing; changes in pesticide residues during vegetable processing.

Oilseeds

Principal research on soybean, cottonseed, and linseed oils, meals, and related products, with concurrent attention to castor, safflower, crambe, and selected oilseeds resulting from the new crops screening program:

Food uses--New process for refining soybean oil with reduction of water pollution; improved flavor stability of soybean oil by selective hydrogenation with new catalysts; removal of objectionable flavors and other undesirable factors from soy flour; soybean protein isolates to replace imported casein; improved low-fat peanut products; roasted peanut products of improved flavor and stability; new food-grade esters from cottonseed oil fatty acids; confectionery and other sharp-melting edible fat from cottonseed oil; edible high-protein cottonseed products; elimination of fungal toxins in cottonseed and peanuts; elimination of salmonella in cottonseed meal products.

Feed uses--Improved cottonseed meals for non-ruminant feed; improved animal feedstuffs from safflower and other western oilseeds; production of safe-to-handle nutritious feed products from castor bean meal; improved protein feed supplements from erucic acid oilseeds.

Industrial uses--Improved durability of linseed oil emulsion paints; linseed oil for curing and protecting concrete; allyl resins from soybean,linseed, and high-erucic oils for coatings and plastics; special-purpose plasticizers from soybean, linseed, and high-erucic oils; nylon-type polyamides from vegetable oils; industrial uses for amides from cottonseed oil; utilization of western seed oils in industrial products.

New and Special Plants

Investigations to develop compositional data on plants from world-wide sources, to find alternate crops to fill needs not now met by domestic sources; and to develop new and more economic uses for special domestic plants:

New alternate crops--Development of paper-making pulp from kenaf by the sulfate process; comprehensive surveys of plant materials for seed fats of industrial utility.

Tobacco--A broadened program to emphasize studies of physiologically-active compounds in tobacco leaf and smoke, determination of products formed on burning leaf tobacco, effect of added chemicals on smoke composition, and development of rapid bioassay methods and measurement of tobacco smoke condensates by these methods.

Naval stores products--New or improved derivatives from rosin for use in adhesives and concrete; condensation polymers from rosin derivatives.

Culture collection--Enhancement of the ARS culture collection, consisting of over 17,000 permanent cultures, used for commercial manufacture of food and industrial products, insecticides, and antibiotics and other pharmaceuticals.

Other crops--Improved systems for collecting and processing maple sap to sirup; development of new or improved products from maple sirup; purification of sweet sorghum juice to permit practical recovery of sugar.

Poultry, Dairy, and Other Animal Products

Development of better and more economical food products from poultry, eggs, milk, and meat, and development of new industrial outlets for fats, hides, and other animal byproducts:

Poultry and eggs--Low-cost, uniform aging for poultry freezing; process modifications to improve and extend the variety of poultry products; elimination of processing damage to egg products; control of salmonella in poultry meat, liquid eggs, and dried eggs.

Dairy products--Dry whole milk for beverage use; sterile concentrated milk for beverage use; stabilized milk fats for use as flavoring agents in foods; low-fat cheese; cheese whey-plant product blends for food use; controlling microbial contamination of dairy products; control of allergens in milk.

Meat products--Improving the stability of meat products; new food product uses for collagen; processing techniques to control microbial contamination of meat and meat products; new, ready-to-eat meat products suitable for production in small rural industries; new frozen meat products.

Animal fats--Biodegradable detergents from animal fats; lubricant components from animal fats; plastics, resins, and plasticizers from animal fats; color and odor stability of commercial fatty acids.

Hides and leather--Improved technology of leather manufacturing, including continuous processing; chemical modification of leather to improve its launderability, perspiration resistance, color-fastness, scuff-resistance, and self-polishing properties; microbiological studies of shearlings for use in hospitals and disinfecting procedures for them.

VI FINANCIAL INFORMATION

The F. Y. 1968 and F. Y. 1969 domestic utilization research and development funds under "Salaries and Expenses, Agricultural Research Service," including allotments from the Special Fund for additional labor, are as follows:

	F. Y. 1968 (Obligations)	Proposed Distribution F. Y. 1969 (Estimated)
Cereal and forage crops	$6,745,752	$7,116,700
Cotton, wool, and other fibers..	6,282,319	6,452,600
Fruits and vegetables	5,033,187	5,323,600
Oilseeds	4,031,633	4,307,600
New and special plants	3,113,516	3,331,500
Poultry, dairy, and animal products	6,617,121	6,731,400
Total, Utilization Research and Development	$31,823,528 a/	$33,263,400 b/

a/ Includes funds for increased pay costs pursuant to Public Law 90-206 and wage board increases.

b/ Includes $111,200 required to place the 1968 increase pay and postage costs on a full year basis and $1,131,400 estimated to meet 1969 pay costs pursuant to Public Law 90-206 and wage board increases.

Supplemental Information

(A) The 1964 Appropriation Act authorized use of $9,716,000 by transfer of CCC and Section 32 funds, for construction at various regional laboratories and field stations, as follows:

Location	Amount	Completion Date
California, Albany	$1,550,000	October 1967
Florida, Olustee	250,000	October 1966
Illinois, Peoria	4,500,000	June 1968
Louisiana, New Orleans	1,465,000	October 1968
Pennsylvania, Wyndmoor	1,485,000	October 1967
Texas, Weslaco	250,000	October 1966
Georgia, Athens (planning)	216,000	(See also below)
Total	$9,716,000	

Supplemental Information (contd.)

(B) Also in FY 1964, $9,500,000 was authorized by Section 32 fund transfers for construction of the laboratory at Athens, Georgia. This building, which will constitute the fifth regional research laboratory, is expected to be completed in May 1969.

(C) The FY 1968 Appropriation Act provided an additional $1,200,000 to complete the Athens laboratory at the scale contemplated when the appropriation was made in 1964, and $50,000 for planning a wool research building at the installation in Albany, California.

(D) In addition to the domestic program, the equivalent of approximately $884 thousand in foreign currencies was obligated in F.Y. 1968 for utilization research projects (largely extending over a five-year period) conducted under agreements with foreign institutions. This work is financed by funds generated under the P. L. 480 program.

(E) The F.Y. 1969 Appropriation Act provided for the following:

(1) Decrease to eliminate funds obligated in 1968 for activities discontinued in 1968 pursuant to P.L. 90-218:

Albany, California	-103,200	
District of Columbia	-71,400	
New Orleans, Louisiana	-35,700	
Beltsville, Maryland	-71,400	
		-281,700

(2) Increase for staffing, equipping and operating new research facilities and to meet other program needs:

Albany, California	283,000	
Pasadena, California	75,000	
Athens, Georgia	50,000	
Peoria, Illinois	299,000	
New Orleans, Louisiana	253,500	
Wyndmoor, Pennsylvania	100,800	
		1,061,300

Supplemental Information (contd.)

(3) Increase for activities planned to be conducted under contracts, grants and cooperative agreements but deferred in 1968:		
Peoria, Illinois	55,000	
New Orleans, Louisiana	40,000	
Wyndmoor, Pennsylvania	36,800	
		131,800
(4) Increase to develop new and improved milk and efficient processing techniques - District of Columbia		40,700
(5) Additional amounts required to place the 1968 increase pay and postage costs on a full-year basis (P.L. 90-206)		111,200
Total		1,063,300

(F) After passage of the F.Y. 1969 Appropriation Act, it was determined that, to comply with Public Law 90-364, a reduction of $984,000 would be effected at various locations through employee attrition.

VII SELECTED RESEARCH ACCOMPLISHMENTS

Examples of the current program of utilization research were given in Section V of this report. In the present section are presented 18 selected examples of recent accomplishment under this program. For the most part, these examples concern research that has proceeded through the applied and developmental stages to the point of commercial acceptance of the processes or products involved. The accomplishments are illustrated on the facing pages.

New Food Protein Concentrate from Wheat

Major flour milling companies are now producing a new type of protein-rich concentrate for use in foods. Based on USDA research reported earlier, the new flour is derived from byproduct fractions normally disposed of in animal feeds at low returns. USDA scientists have cooperated closely with industry in scaling up production of this high-protein ingredient and developing new products based on its use. Amber in color and mild in flavor, the concentrate contains 20 to 35 percent protein and is rich in the scarce amino acid, lysine. Useful in such domestic products as baked goods and ready-to-eat breakfast cereals, it is now being used in high-protein products for food aid programs overseas. One of the latter is a protein-enriched flour for Asiatic baked products that has a bright future for commercial exports. Most significant is the availability of a protein concentrate for human feeding at a cost of about 5 cents per pound at the processor level. More than a million tons of food-grade concentrate can be produced per year, and nearly as much of a less refined version will be available for use as an upgraded poultry feed ingredient. Major flour millers will benefit directly, and growers will share indirectly in the benefits.

NEW WHEAT MILLING PROCESS PRODUCES FOOD PROTEIN CONCENTRATE

- 20-35% PROTEIN
- RICH IN AMINO ACID
- AMBER COLOR
- MILD FLAVOR

COMMERCIAL EXPORT POTENTIAL

Wheat Starch Achieves Major Market in Pacific Northwest

A process developed by USDA scientists that separates wheat flour into starch and food-grade vital gluten served as a basis for a recently completed plant in the Pacific Northwest. For the first time, industrial wheat starch is available in the area and is being used by the regional pulp and paper industry. At least three large paper companies now use multimillion-pound quantities of wheat starch annually.

The company producing the starch consulted extensively with USDA scientists on the plant process design, on the physical and chemical properties of wheat flour and its mechanical behavior, and on the processing and application techniques for wheat starch in paper.

Five other American wheat starch plants located elsewhere are largely based on the USDA-developed process. Previously, wheat had been used primarily in food and speciality applications.

Industrial Outlet For WHEAT STARCH

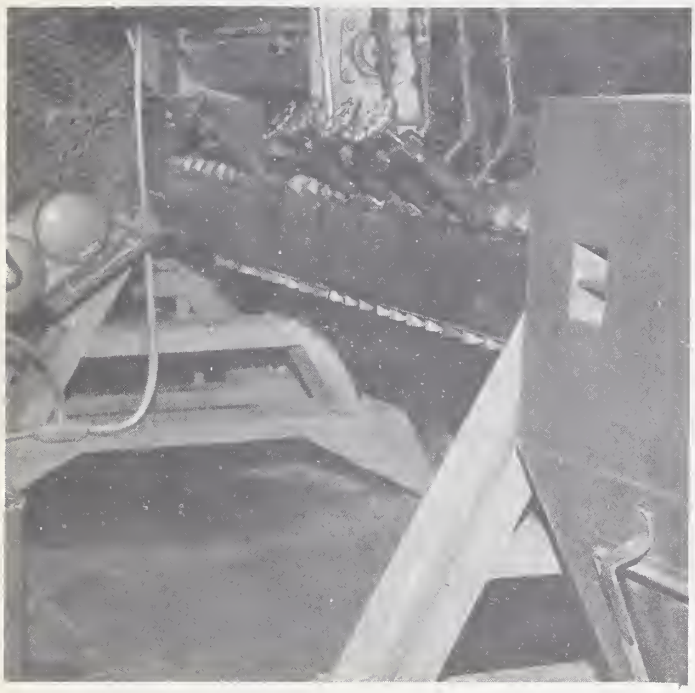
Wheat Flour Separation Process has Led to Development of Commercial Plants to Service Pulp and Paper Industry

THE 6 WHEAT STARCH PLANTS IN OPERATION IN U.S. ARE BASED ON THE DEPARTMENT DEVELOPED PROCESS

Processing Corn Fractions for Use in Food Blends

USDA engineers have developed processing conditions for precooking corn endosperm fractions by means of an extrusion cooking system, to yield a product that is useful in gruel mixes. Processing or precooking of corn grits, meal, or flour is necessary when the corn product is to be used in food blends that are partially or completely precooked. As a direct result of this work, at least three commercial corn processors have been able to use their extrusion equipment for producing partially-precooked corn of the proper characteristics for use in CSM (corn-soya-milk) food blend for distribution abroad by voluntary relief agencies. The corn fraction constitutes over 60 percent of the total blend. CSM is an excellent protein supplement in the diets of weanling and preschool-age children. Use of these processed corn products in the donation programs alone could easily amount to as much as 300 million pounds per year, corresponding to about 10 million bushels of corn.

Processing Corn for CSM



Extrusion Cooking System Processes Corn Fractions for Use in Precooked Food Blends

- CSM Contains Over 60% Corn
- Donation Programs Have Used 800 Million Pounds

Bale Opener-Blender Ready for Commercialization After Successful Mill Trials

One of the most promising textile machines yet developed by USDA scientists is the Bale Opener-Blender (BOB), which actually surpassed its design capability during recent large-scale evaluation tests in a commercial mill. These tests prove that the BOB, designed to have a production rate of 1,000 pounds per hour, was in fact capable of processing 1,200 pounds per hour continuously and 2,000 pounds per hour intermittently--many times the production rate of a conventional blender. In addition to its speed, the BOB has many advantages. It reduced the number of bales required in a mix from 43 to 20. It replaced seven machines used in a three-picker opening line. Its feed control compensates for irregularities in size and density of the bales and renders the machine completely automatic except for loading. But the ultimate criterion, of course, is the quality of fabric produced from the blended cotton, and here the BOB excels; the resulting fabric was 30 percent higher in grade than that produced from cotton processed by a conventional hopper feeder system. Because of these features, use of the BOB will reduce costs an estimated one-fourth cent per pound of cotton processed. Since mills operate 24 hours a day, six days a week, a single BOB operating even at its lowest production rate of 1,000 pounds per hour would achieve an annual savings of $180,000.

TEXTILE MACHINE EXCEEDS EXPECTATIONS

Bale Opener Blender (BOB) Developed through Research for a More Uniform Blend of Cotton . . .

Has Been Proved Under Mill Conditions

- ✓ **HIGH PRODUCTION RATE**
  Designed to Blend 1000 lb. per hr.
  Capable of 1200 lb. per hr.
- ✓ **EFFICIENT BLENDING**
  In Mill Tests BOB Reduced Number of Bales Required from 43 to 20
- ✓ **HIGH QUALITY FABRIC**
  30% Higher Grade than by Conventional Method

EACH BOB SAVES $180,000 A YEAR

Soil Release Finish Improves Cotton's Position in the Durable-Press Market

An estimated two million bales of cotton are used annually for end uses in which soil resistance and ease of soil removal are of significant importance. Research by USDA scientists has led to the commercial production of wash-wear and durable-press cottons that soil less readily, clean more easily, and stay brighter during their service life. This enhancement of cotton's position in a lucrative market was achieved by the development of a practical soil release finish that simultaneously imparts wash-wear or durable-press properties to cotton. The finish is durable to repeated laundering and dry cleaning, and its application does not adversely affect either the color or the tensile strength of the cotton. Within a short time after publication of information about the new soil release finish, the textile industry and chemical manufacturers announced production of at least twelve soil release agents, most--if not all--of which are similar to the one described by the USDA scientists. Since then commercial interest has continued at a high level.

Soil Release Finish For Cotton

Industry Adopts USDA Soil Release Finishing Agent That Makes WASH-WEAR and DURABLE-PRESS Cotton Easy to Clean

Modified One-Step Polyset Process Under Evaluation by Industry for Production of All-Cotton Durable-Press Sheets

USDA scientists have developed a simple one-step chemical finishing process that appears to have good potential for the commercial production of all-cotton durable-press sheets and pillowcases. Six textile mills are either evaluating or adapting the process at the present time. In comparison with conventional durable-press processes, the new technique yields cotton sheetings with increased abrasion resistance and strength, and therefore greater durability and longer wear-life. These improved properties should enable all-cotton durable-press bed linens to compete with comparable cotton-polyester blended products that have recently made inroads into a textile market that is not only large--16 million dozen sheets and 16 million dozen pillowcases annually--but also has traditionally been dominated by cotton.

All-Cotton, "NO IRON" Sheets For Todays' Market

Modified One-Step Polyset Process Under Evaluation by Industry for Production of ALL-COTTON DURABLE-PRESS SHEETS

Improved Shrinkproofing Treatment for Wool

Experimental industrial trials have demonstrated the superiority of a new USDA shrinkproofing treatment for wool. The new treatment, in which a polyurea finish is applied, is technologically superior to earlier polymer processes. Specific advantages include more effective shrinkproofing, softer handle for the treated fabrics, improved stability of the reactant baths, simplification of process control, and lower chemical costs. The process is being actively evaluated by manufacturers of woven fabrics, blankets, and knit goods, as well as by producers of wool-containing durable press apparel. The improved quality of product and simplification of process control should accelerate the commercial use of treated wools, with major benefits to the consumer in convenience and lower maintenance costs of machine-washable wool garments. Sheep raisers should profit from greater use of wool in garments. The fabric producer also benefits from economies in manufacturing costs made possible by the use of this new polyurea process.

Improved Shrinkproofing to INCREASE WOOL USE

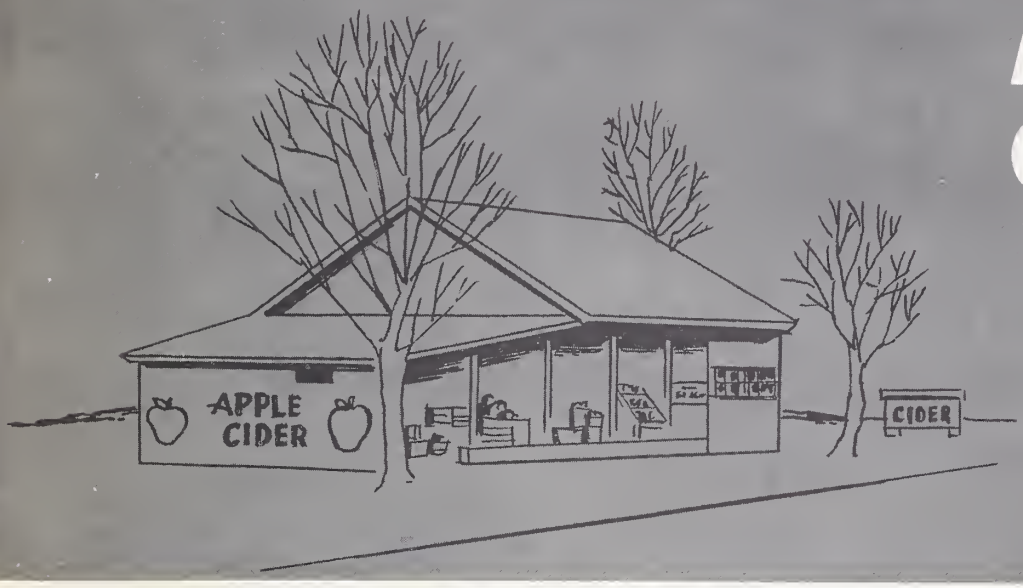
Superior Shrinkproofing of Latest USDA Treatment... Encourages Greater Use of Machine Washable Apparel, Blankets and Knit Goods

- LOWER MANUFACTURING COSTS
- HIGH QUALITY STABLE PRODUCT

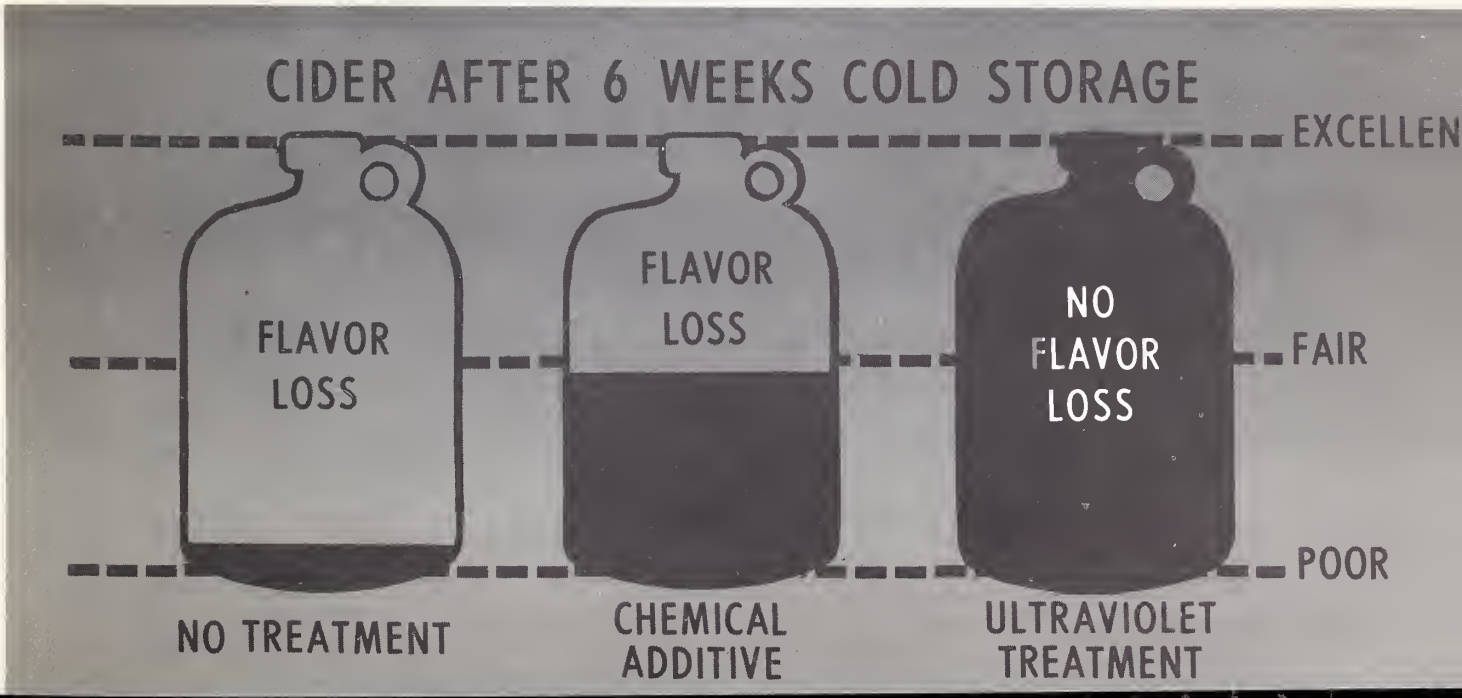
Ultraviolet Pasteurization of Apple Cider

Farm-fresh apple cider can now retain its "straight-from-the-press" flavor longer if exposed to germ-killing ultraviolet irradiation during processing. USDA scientists developed a simple process which increases the refrigerated shelf-life by several weeks because 95 percent or more of the spoilage microorganisms normally found in fresh cider are destroyed. In contrast to older chemical preservative methods, this process does not affect the flavor, since nothing is added to the cider. The process is intended for relatively small operations and should help to expand markets for grower-produced cider by safeguarding the natural apple cider flavor through longer transportation and storage periods.

FLAVOR SAVING PROCESS FOR APPLE CIDER



Ultra-Violet Pasteurization Expands Market for Grower-Producer by Flavor Protection in Transit and Storage



Brine Draining of Cucumbers Saves Pickle Industry Millions of Dollars a Year

Brine draining, an innovation developed by USDA scientists to prevent cucumber pickles from becoming soft and spoiling, is now credited with saving the industry $25 million a year. The procedure resulted from fundamental research that identified enzymes originating from mold growth in cucumber flowers as the cause of breakdown in the cellular structure of the cucumbers. After it was discovered that the enzymes were extracted into the brine, the problem was solved by developing a method to detect which vats were involved and then replacing the brine in them. Since then, the use of brine draining has increased steadily; in 1955, the first year that it was used extensively in the southern states, about 2 million bushels of brined cucumbers were drained; in 1967, the procedure was applied to one-third of the crop--6.7 million bushels in 21 plants. Moreover, although pickles already rank among the five best-selling canned vegetables, the industry, now valued at $325 million retail, is continuing to grow rapidly; hence the present annual saving of $25 million also can be expected to increase.

SCIENTIST DISCOVERED THAT ENZYMES FROM CUCUMBER FLOWER MOLD CAUSED CUCUMBERS TO SPOIL IN PICKLING VATS....

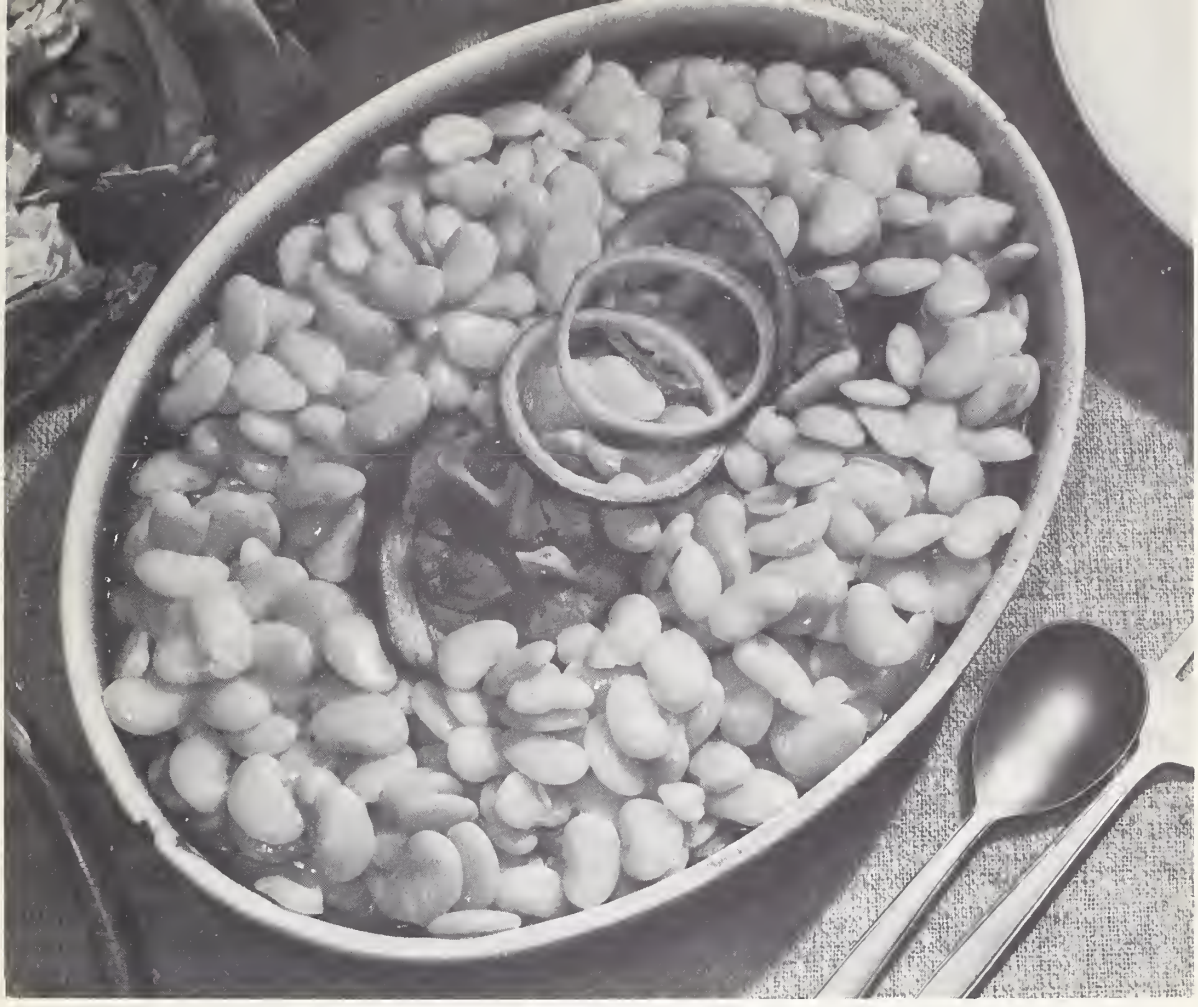
BRINE DRAINING AND REPLACEMENT PROCEDURE REDUCED SPOILAGE OF CUCUMBERS AND IMPROVED QUALITY

REDUCING CUCUMBER PICKLE SPOILAGE

Method of Detection and Brine Draining Saves Pickle Industry $25 million a Year

Frozen, Quick-Cooking Beans

A process for preparing a variety of quick-cooking (5-15 minutes) frozen products from dry lima, pinto, small white, blackeye, and soy beans has been developed by USDA scientists, supported in part by the California Lima Bean Advisory Board. The cooked beans have an enhanced natural flavor, a smooth uniform texture, and excellent appearance. The products provide consumers with a new type of economical, high-protein, convenience food. Frozen food processors can produce them during their slack season, when plants would otherwise be idle. If the products are produced on demand, warehousing costs can be saved. The frozen bean products will provide opportunities for the development and marketing of convenience foods such as frozen vegetable and soup mixes and bean-meat casseroles. Pilot plant production of frozen, quick-cooking products from several types of dry beans has been initiated by two leading frozen food processors.



New Outlet for DRY BEANS

Process Converts Dry Beans
Into a Quick Cooking
Frozen Food Product

- HIGH IN PROTEIN
- ECONOMICAL
- NATURAL FLAVOR
- TENDER

Practical Process for Producing Cottonseed Flour Under Evaluation at Home and Abroad

Throughout the world there is general agreement that protein from new sources must be introduced into the human diet. USDA scientists have responded to this need by devising a method for preparing edible, high-protein flour from cottonseed. This method, called the Liquid-Cyclone Process, concentrates most of the protein in one fraction and simultaneously transfers most of the gossypol, a deleterious pigment of cottonseed, into the other fraction. The first fraction, a fine flour that is bland in flavor and light in color, produces highly acceptable bakery products when mixed with wheat flour. The other fraction, a coarse meal, can be mixed with a feed product or used as fertilizer. Estimates based on numerous experimental runs indicate that the United States could produce about two million tons of cottonseed flour annually, and the rest of the world could produce another six million tons. Economics of the process are favorable. Whereas most of the domestic cottonseed crop is now restricted to livestock feed, which sells for about four cents per pound, the high-protein fraction used for food could sell for about nine cents per pound, only half the cost of soybean concentrate. Another attractive feature is that most of the equipment required is the same as that used in many plants that already process cottonseed. At least two domestic firms are investigating the process, and AID has contracted for construction of a pilot plant in India, where ten tons of the flour will be produced from Indian cottonseed and then test-marketed.

ECONOMICAL HIGH PROTEIN FLOUR FROM COTTONSEED

...Practical Process for Producing Cottonseed Flour Under Evaluation at Home and Abroad...Light-Colored, Bland-Flavored Cottonseed Flour Mixes with Wheat Flour for Many Food Uses

LIQUID CYCLONE PROCESS DIVIDES COTTONSEED...

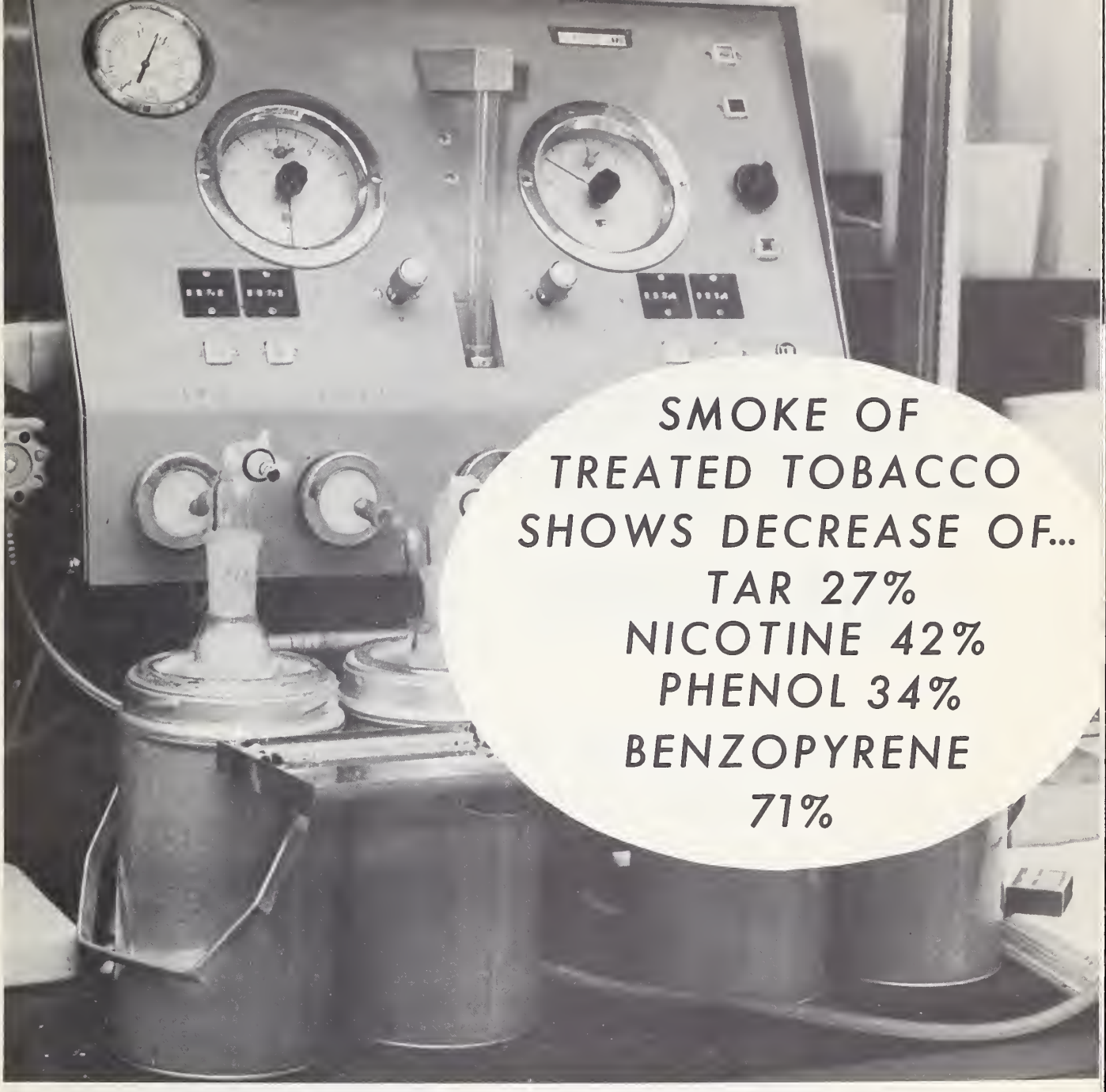
...INTO 2 FRACTIONS

Flour for Food

Meal for Feed

Modifying Cigarette Smoke Composition

The effect of chemicals in modifying the composition of tobacco smoke is being determined as part of a USDA program on tobacco and health, conducted cooperatively with the University of Kentucky. Cigarette tobacco is being treated with chemicals such as flame retardants, free-radical scavengers, oxidants, and temperature depressants. Some changes in the levels of possible health-related smoke constituents have been detected. Decreases of 27 percent for total particulate matter (tar), 42 percent for nicotine, 34 percent for phenol, and 71 percent for benzo(a)pyrene were obtained. The smoke from the treated tobacco will also be assayed biologically on laboratory animals, to determine whether any correlation exists between the decreased levels of the selected smoke components and the tumorigenicity of the smoke. The development of this information will be a major step in selecting additives of practical importance.



MODIFYING CIGARETTE SMOKE COMPOSITION

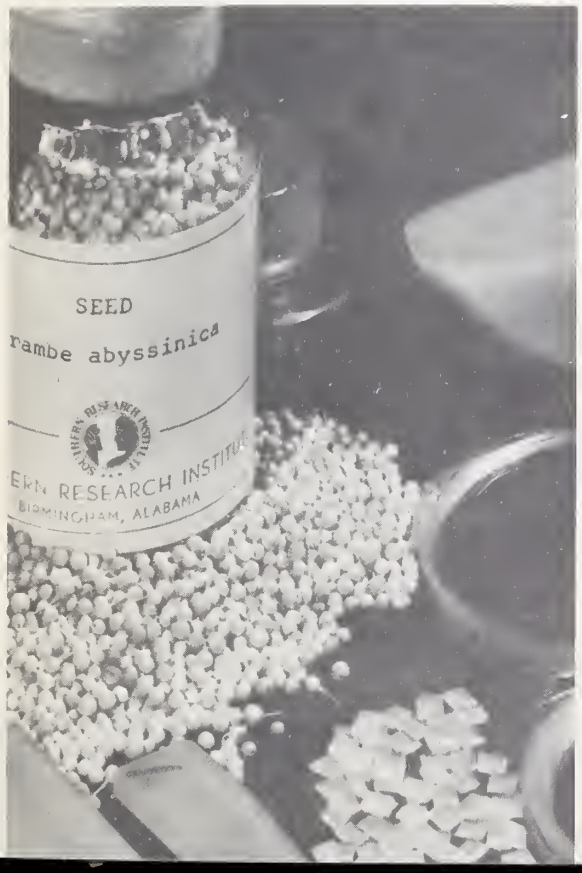
Research Conducted to Determine if Additives in Tobacco Alter Smoke Composition in Relation to Health

A New Nylon from an Agricultural Raw Material

A new nylon with outstandingly useful properties has been prepared under the USDA research program on new crops. Laboratory studies show that this new product, called nylon 1313, is easily made from the oil of crambe seed, which is being developed as a new crop for the United States. Nylon 1313 is very tough, has low moisture absorption, and flows easily at lower temperatures than textile-type nylons. These characteristics are valuable for metal coatings and adhesives, bearings, electrical insulators, brush bristles, food-wrapping films, and other molded and extruded articles. Nylon 1313 samples have been requested by more than 36 companies for evaluation in specific applications. Demonstrated ease of laboratory preparation and the favorable properties found for nylon 1313 provide a needed basis for development work directed toward commercialization.

New Crops Research Yields NYLON 1313

Product from Oil of CRAMBE SEED is Under Evaluation by Industry



... NYLON 1313

Has Valuable Characteristics for...

METAL COATINGS
ADHESIVES
BEARINGS
ELECTRICAL INSULATORS
BRUSH BRISTLES
WRAPPING FILMS
...AND OTHER MOLDED OR EXTRUDED ARTICLES

Kenaf for Paper Pulp

USDA research has shown that both green kenaf, as early as 120 days after planting, and dry kenaf produce high-quality paper pulp. Therefore, kenaf can be harvested and used over a period of months without expensive storage or preprocessing. The suitability of green kenaf for pulp is especially advantageous in the South, where it stays green until late fall.

Kenaf is a high-yielding new annual crop that grows well in the southern region of the United States. Test plantings have given fiber production two or three times greater than fast-growing woods. In pulp characteristics it is equal to or better than hardwood pulp.

The major paper companies are now evaluating the production and utilization of kenaf based on USDA findings. In 1967 over 30 industrial companies participated in a technical conference on kenaf. A special committee of industry and government scientists has been set up by the Technical Association of the Pulp and Paper Industries to assist in the overall evaluation.

KENAF PRIME ANNUAL PAPER PULP CROP

New Annual Fiber Crop Provides Advantages Over Pulp Wood

HIGH YIELDING

FAST GROWING

ECONOMICAL HARVESTING

EASY PROCESSING

QUALITY PRODUCT

CROP ADAPTABLE TO GROWING IN U.S.

Glutaraldehyde-Tanned Leather in Combat Gear

To meet a need for rugged and durable combat footwear, the Armed Forces designed a boot with an upper made partly of leather and partly of nylon fabric. The latest improvements in leather properties make these boots more resistant to wetting by water and to deterioration from perspiration. In producing this improved leather, industry adopted the results of research conducted by USDA scientists, which demonstrated that the new tanning agent, glutaraldehyde, not only confers on leather exceptional resistance to deterioration from perspiration, but also makes treatment with water-repellent agents more efficient. The improved leather is being used also for work shoes, sporting boots, and other civilian footwear.

Scientists Meet Demand for Durable Combat Gear...

DEVELOPMENT OF TANNING AGENT, GLUTARALDEHYDE, IMPROVES EFFECTIVENESS OF WATER-REPELLENT TREATMENTS FOR LEATHER, AND IMPROVES PERSPIRATION RESISTANCE

Created for Armed Forces...
Now Used for Civilian Footwear

Improved Pasteurization of Egg Products

Whole egg has been pasteurized successfully for more than 10 years, and it has been generally assumed that the conditions used to treat whole egg would be satisfactory for other egg products. However, USDA studies have shown that the recommended conditions of heat treatment for whole egg are not adequate for yolk, sugared yolk, or salted yolk. To achieve equivalent degrees of safety, yolk must be held at a temperature of 2°F. higher, and salted or sugared yolk must be held at a temperature 6°F. higher, than whole egg during the standard $3\frac{1}{2}$-minute pasteurization. These findings have led to improved pasteurization practices in the egg industry and to revised regulations governing the grading and inspection of egg products. These improved practices assure the adequacy of current egg pasteurization operations for all egg products.

EGG SAFETY RAISED BY THE TEMPERATURE

Standard Pasteurization of Whole Egg

Inadequate for Yolk Products

YOLK

YOLK Sugared Salted

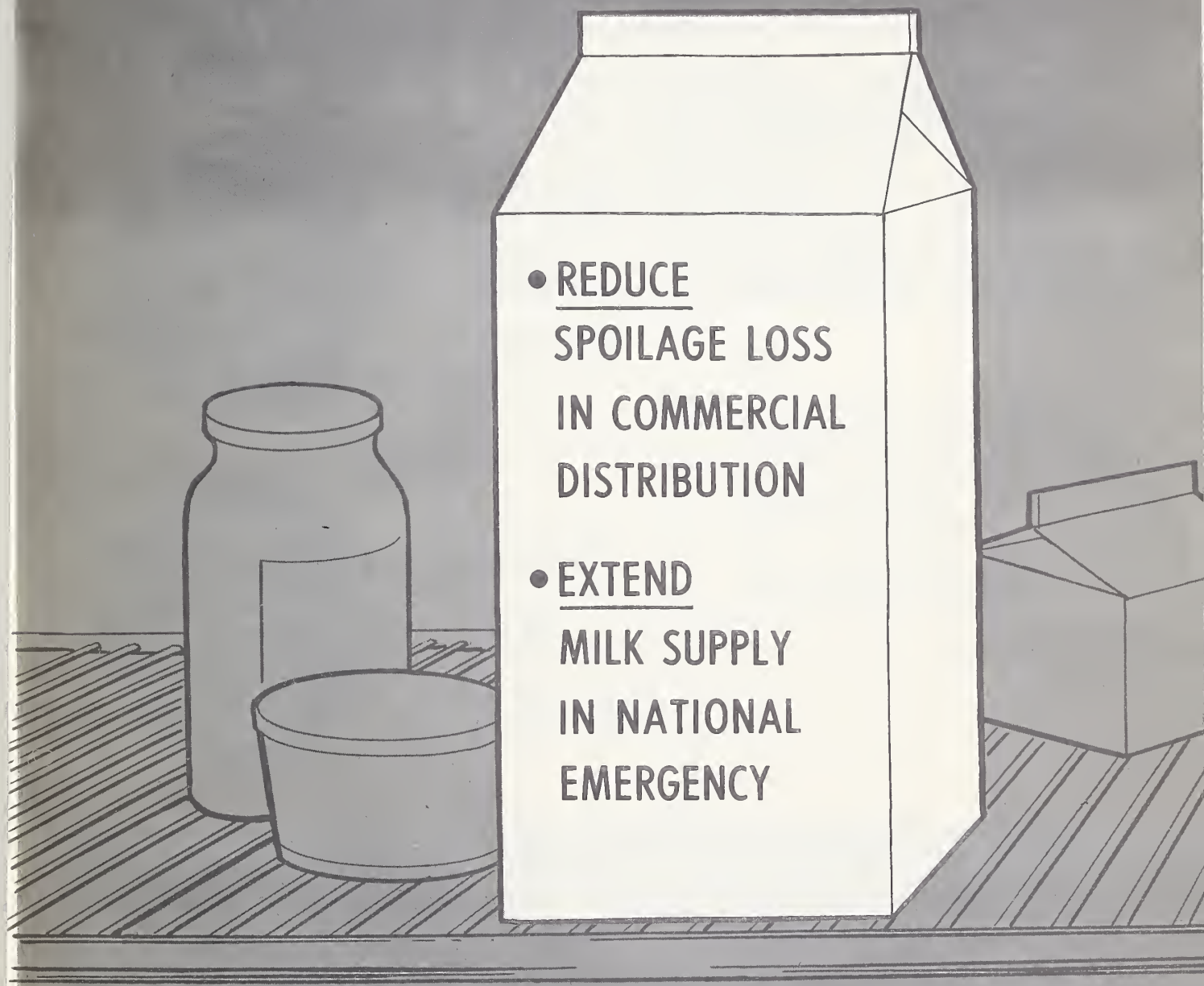
...Increased Temperature Insures Safety

GRADING AND INSPECTION REGULATIONS CHANGED TO MEET NEW PASTEURIZATION REQUIREMENTS

Milk Storage in Nuclear Emergencies

USDA-sponsored contract research by an industrial concern has proved that commercially-pasteurized milk can be stored long enough to permit the decay of radioactive iodine contamination to safe levels. Iodine-131 is transmitted to milk in significant amounts from transitory fallout. Because its half-life is 8 days, the radioactivity almost disappears within 40 days. But at current commercial storage conditions of 45° F., the milk flavor and bacteriological quality deteriorate before the iodine-131 can decay sufficiently. This research has shown that a storage temperature of 32°F. extends the shelf-life fivefold to about $4\frac{1}{2}$ weeks. Also, milk which has been pasteurized by ultra-high-temperature methods and refrigerated at 32°F. will keep for as long as 20 weeks. Aimed primarily at extending our milk supplies in nuclear emergencies, this research is also of immediate practical importance to dairy manufacturers and retailers. It emphasizes the advantages of lower storage temperatures in increasing product shelf life and in reducing loss due to spoilage. The same advantages may also apply to other dairy products such as cottage cheese.

Milk Shelf-Life Increased by Decreased Storage Temperature



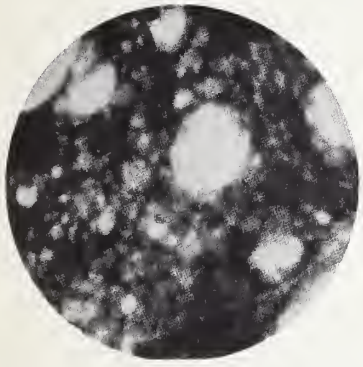
Milk Stored at 32° F Retains Quality Up to 6 Weeks

Fat Analysis Technique Improves Sausage-Making Technology

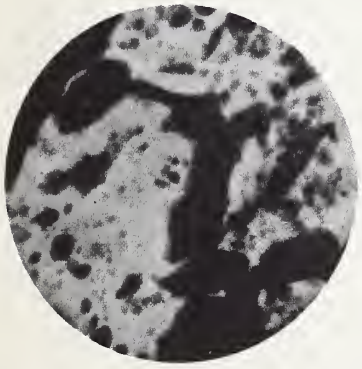
Sausage makers can now improve quality and processing efficiency by taking advantage of a precise research tool adapted for them by USDA meat scientists to determine the melting characteristics of their fats. Sausage emulsions are made by high-speed mixers which blend together the ingredients, essentially meat, fat, salt, and chopped ice. The temperature generated in these mixers is critical. It must be high enough to secure a good dispersion of the fat with the protein of the meat, but if it is excessive the emulsion will "break"; that is, the fat will come out of the emulsion when it is smoked, ruining the product. This critical temperature is related to the melting temperature of the fat mixture. In the past, processors have had only an imprecise notion of the critical mixing temperature, based on past experience with different types of fats. They thus tended to keep well below this temperature. Now, through differential thermal analysis, sausage makers can precisely determine the melting temperature of the particular combination of fats being used in a given formulation, and adjust their processing conditions accordingly so as to operate at the highest possible safe temperature. Or they can select that mixture of fats that will provide a melting temperature suited to a given operating procedure.

DIFFERENTIAL THERMAL ANALYSIS TECHNIQUE

EFFECT OF TEMPERATURE ON SAUSAGE EMULSION



35°- 65°F
GOOD
TEXTURE



35°-80°F
FAT
SEPARATION

New Method for Quality Control in Emulsion-Type Sausage Production

Predicts Highest Safe Temperatures in Sausage Processing... Could Aid in Annual Production of 3 Billion Pounds of Sausage-- A 1½ Billion Dollar Market